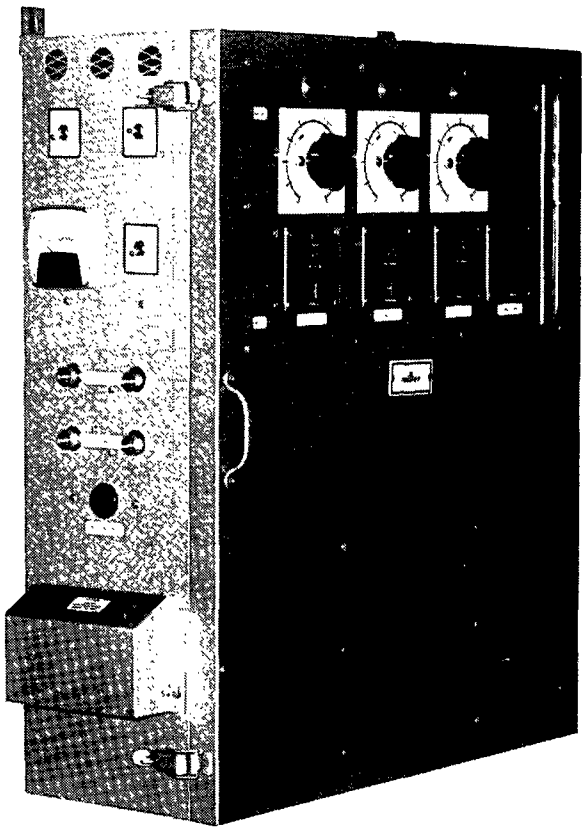
February 1980 FORM: OM-540A

Effective With Serial No. HK321565

MODEL

SCE-1A
SCE-3A
SCE-5A
SCM-1A
SCM-3A
SCM-5A



OWNER'S MANUAL

MILLER ELECTRIC MFG. CO.
718 S. BOUNDS ST. P.O. Box 1079
APPLETON, WI 54912 USA

NWSA CODE NO. 4579
PRINTED IN U.S.A.

LIMITED WARRANTY

EFFECTIVE: JUNE 1, 1979

This warranty supersedes all previous MILLER warranties and is exclusive with no other guarantees or warranties expressed or implied.

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Except as specified below, Miller's warranty does not apply to components having normal useful life of less than one (1) year, such as spot welder tips, relay and contactor points, MILLERMATIC parts that come in contact with the welding wire including nozzles and nozzle insulators where failure does not result from defect in workmanship or material.

Miller shall be required to honor warranty claims on warranted Equipment in the event of failure resulting from a defect within the following periods from the date of delivery of Equipment to the original user:

1. Arc welders, power sources and components .. 1 year
2. Original main power rectifiers ..... 3 years (labor - 1 year only)
3. All welding guns and feeder/guns ..... 90 days
4. All other Millermatic Feeders..... 1 year
5. Replacement or repair parts, exclusive of labor . 60 days
6. Batteries..... 6 months

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In the case of Miller's breach of warranty or any other duty with respect to the quality of any goods, the exclusive remedies therefore shall be, at Miller's option (1) repair or (2) replacement or, where authorized in writing by Miller in appropriate cases, (3) the reasonable cost of repair or replacement at an authorized Miller service station or (4) payment of or credit for the purchase price (less reasonable depreciation based upon actual use) upon return of the goods at Customer's risk and expense. Upon receipt of notice of apparent defect or failure, Miller shall instruct the claimant on the warranty claim procedures to be followed.

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SECTION 1 - INTRODUCTION

Dimensions (Inches)			Weight (Pounds)	
Height	Width	Depth	Net	Shipping
33-1/4	26-1/4	10-3/4	168	230

Figure 1-1. Specifications

1-1. GENERAL

This manual has been prepared especially for use in familiarizing personnel with the design, installation, operation, maintenance, and troubleshooting of this equipment. All information presented herein should be given careful consideration to assure optimum performance of this equipment.

1-2. RECEIVING-HANDLING

Prior to installing this equipment, clean all packing material from around the unit and carefully inspect for any damage that may have occurred during shipment. Any claims for loss or damage that may have occurred in transit must be filed by the purchaser with the carrier. A copy of the bill of lading and freight bill will be furnished by the carrier on request if occasion to file claim arises.

When requesting information concerning this equipment, it is essential that Model Description and/or Stock Number and Serial (or Style) Numbers of the equipment be supplied.

1-3. DESCRIPTION

These Sequence Controls are specifically designed to be used in conjunction with an electric current controlled welding power source. These Sequence Controls provide five different sequences for either automatic or semi-automatic operation of the various welding processes. The function of each sequence is described in Section 3, FUNCTION OF CONTROLS, in this manual. The SCE Models are equipped with electronic timers in sequences B, C, and D. The SCM Models are equipped with mechanical timers in sequences B, C, and D.

1-4. SAFETY

Before the equipment is put into operation, the safety section at the front of the welding power source or welding generator manual should be read completely. This will help avoid possible injury due to misuse or improper welding applications.

The following definitions apply to CAUTION, IMPORTANT, and NOTE blocks found throughout this manual:

CAUTION

Under this heading, installation, operating, and maintenance procedures or practices will be found that if not carefully followed may create a hazard to personnel.

IMPORTANT

Under this heading, installation, operating, and maintenance procedures or practices will be found that if not carefully followed may result in damage to equipment.

NOTE

Under this heading, explanatory statements will be found that need special emphasis to obtain the most efficient operation of the equipment.

SECTION 2 - INSTALLATION

2-1. ELECTRICAL INPUT CONNECTIONS

Refer to the Installation Section of the welding power source *Manual for instructions on connecting* electrical input power to the welding power source.

On the SCE/SCM-1A and 3A Models, inside the cabinet on the lower right corner above the control transformer, is either a three or a five pole terminal block with one jumper link attached. The primary power supply to the Sequence Control is connected to this block. The jumper link must be connected for the primary power supply voltage that will correspond with the primary power supply voltage of the welding power source. Refer to Figure 2-1 for positioning of the link for the required operating voltage.

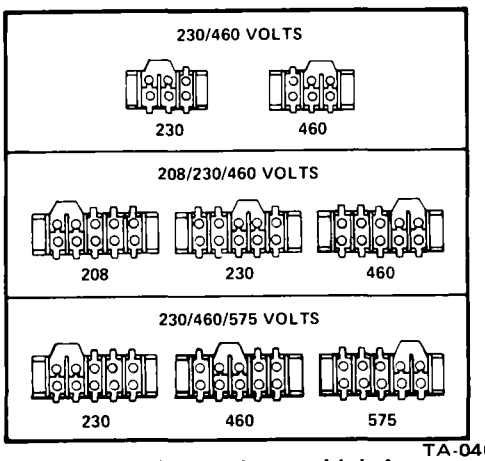

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Figure 2-1. Line Voltage Jumper Link Arrangement

On the SCE/SCM-5A, the control transformer which provides the primary power to the control is located in the welding power source.

2-2. SECONDARY CONNECTIONS (Figure 2-2)

NOTE

This unit was shipped with the secondary interconnecting cables between the Sequence Control and welding power source unconnected. It is therefore necessary to route and secure the secondary interconnecting cables (already attached to Sequence Control) to the proper weld output terminals on the welding power source. The secondary welding cables should only be attached to the output terminals on Sequence Control to achieve proper operation of this unit.

Refer to Installation Section of the welding power source Owner's Manual for proper weld cable size.

The secondary terminals on the Sequence Control are labeled ELECTRODE and WORK. Connect the electrode holder cable to the terminal marked ELECTRODE and the work cable to the terminal marked WORK.

2-3. SHIELDING GAS CONNECTIONS (Figure 2-2)

These connections are located on the front panel and are labeled IN-GAS-OUT. The connections have a right-hand,

5/8-18 female thread. Connect the hose from the shielding gas supply to the connection labeled IN. Connect the hose from the electrode holder to the connection labeled OUT.

2-4. COOLANT CONNECTIONS (Figure 2-2)

These connections are located on the front panel and are labeled IN-COOLANT-OUT. The connections have a left-hand, 5/8-18 female thread. Connect the hose from the coolant supply to the connection labeled IN. Connect the hose from the electrode holder to the connection labeled OUT.

IMPORTANT

If a portable, self-contained coolant system is used with this unit, ensure that the coolant pump has bypass capability to avoid possible damage to the motor when the coolant valve closes and coolant flow stops.

2-5. CONTACTOR CONTROL RECEPTACLE (Figure 2-2)

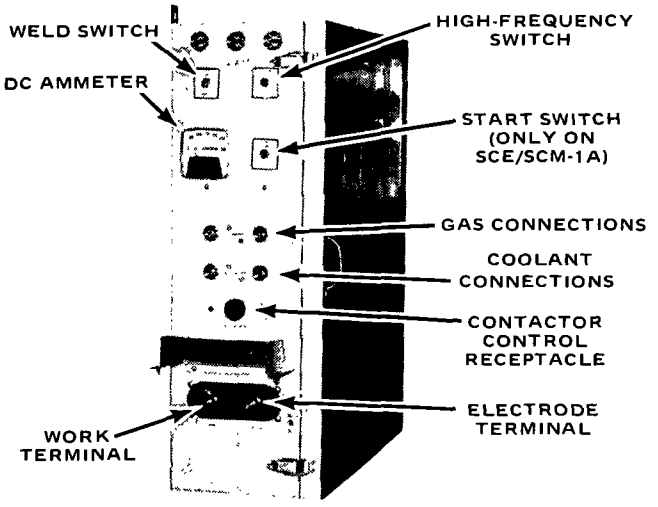

Figure 2-2. Front Panel View

This three-prong, twistlock receptacle provides contactor control facilities. Either a remote hand or foot switch can be used in conjunction with this receptacle.

2-6. EMERGENCY STOP SWITCH CONNECTIONS (Figures 2-3 and 3-2)

A five-pole terminal block with two jumper links attached, located on the inside lower left corner of the cabinet, provides a means of emergency stop connections of weld sequences B, C, or D. If it is desirable to connect an emergency stop switch in the circuit, remove the jumper link that is connected across the fourth and fifth terminals, counting left to right. Connect a normally-closed switch to the terminals from which the link was removed.

With the WELD switch in the AUTOMATIC position, weld sequences B, C, or D may be interrupted at any time by opening the emergency stop switch. Opening of this switch will initiate sequence E (post-flow time).

2-7. MANUAL CONTROL CONNECTIONS OF SEQUENCE C (Figures 2-3 and 3-2)

A five-pole terminal block, with two jumper links attached, located on the inside lower left corner of the cabinet, provides a means of external switch control of sequence C. To connect an external switch for manual control of sequence C, remove the jumper link connected across the first and second terminals counting left to right. Connect a normally-open switch to the terminals from which the link was removed.

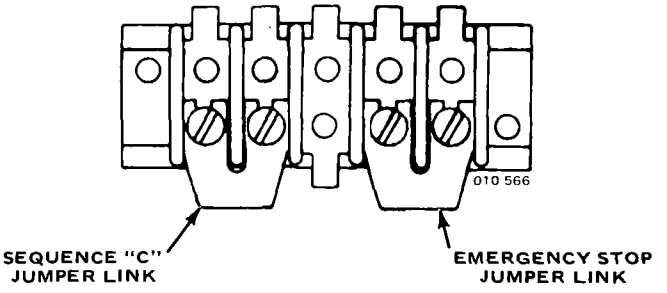

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Figure 2-3. Terminal Block For External Switch Operation

SECTION 3 - FUNCTION OF CONTROLS

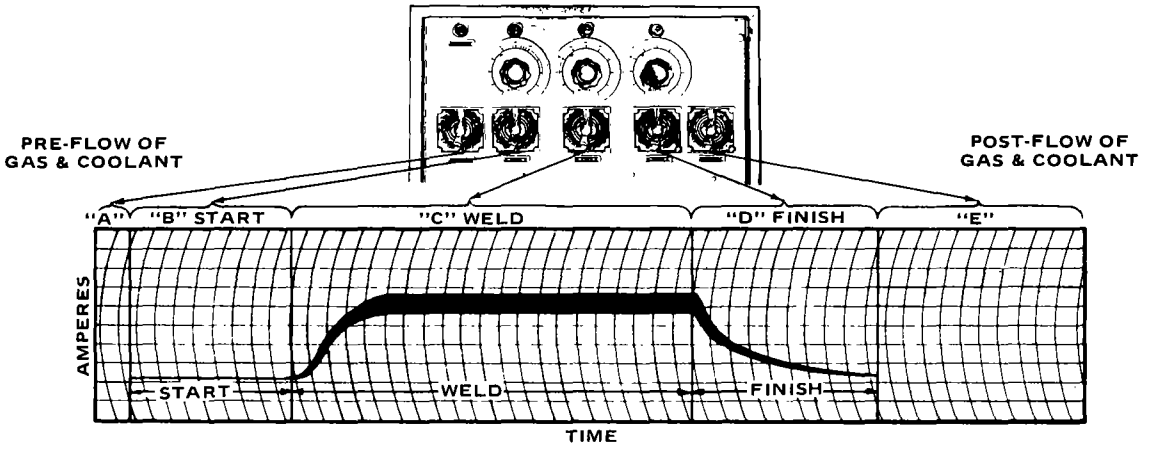

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Figure 3-1. Sequence Time Chart

3-1. SEQUENCE CONTROL FUNCTION (Figure 3-1)

This Sequence Control is a five sequence automatic control designed for Gas Tungsten-Arc Welding (GTAW). The function of each sequence is as follows:

Sequence A: PRE-FLOW: gas and coolant; adjustable mechanical time of 1/4 to 15 seconds.
Sequence B: START current: adjustable control and timer preset magnitude of current and time.
Sequence C: WELD current: adjustable control and timer provide exact values of current and time. Sequence can be manually controlled.
Sequence D: SLOPE current: adjustable control and timer are preset to determine magnitude and time duration of current at end of weld.
Sequence E: POST-FLOW: gas and coolant; adjustable mechanical time sequence of 2 seconds to 3 minutes.

3-2. CURRENT CONTROL (Figure 3-2)

The welding current for sequences B, C, and D is governed by the setting of the control immediately above each sequence timer. These controls are calibrated in percentages and function as remote controls, in that they are fine amperage adjustments of the AMPERAGE ADJUSTMENT control on the welding power source. The REMOTE AMPERAGE CONTROL switch on the welding power source must be in the STANDARD position for proper operation of the Sequence Control.

NOTE

The AMPERAGE ADJUSTMENT control on the welding power source must be in the one hundred percent (maximum) position for maximum control of the selected range.

A. Start Weld Amperage Control (Sequence B)

The START control is provided for selecting the start weld current value. The control is adjustable and can be set for any value from the minimum to the maximum of the selected current range on the welding power source. For a normal start the control should be set for a value less than the WELD (sequence C) setting.

B. Weld Amperage Control (Sequence C)

The WELD control is provided for selecting the normal weld current value. The control is adjustable and can be set for any value from the minimum to the maximum of the selected current range on the welding power source.

C. Slope Weld Amperage Control (Sequence D)

The SLOPE control is provided for selecting the slope weld current value. The control is adjustable and can be set for any value from the minimum to the maximum of the selected current range on the welding power source. For a normal finish the control should be set for a value less than the WELD (sequence C) setting.

3-3. START SWITCH (SCE/SCM-1A) (Figure 2-2)

This switch provides a choice of selecting either a normal or a fast start of sequence B (START weld).

A. Normal Position

With the switch in the NORMAL position, the starting current will start at a value less than the setting of the START weld amperage control, but will rapidly increase to the setting of the START weld amperage control.

B. Fast Position

With the switch in the FAST position, the starting current will start at the value of the START weld amperage setting.

3-4. WELD SWITCH (Figure 2-2)

This switch provides a choice of selecting either an automatic or semi-automatic operation of the Sequence Control.

A. Automatic Position

With the switch in the AUTOMATIC position, the Sequence Control will operate automatically through all sequences with the use of a contactor control switch connected to the CONTACTOR CONTROL receptacle.

B. Manual Position

With the switch in the MANUAL position, the timers of sequences B, C, and D are removed from the circuit. However, the weld sequence current value will be controlled by the WELD amperage control on the Sequence Control. Closing the contactor control switch will initiate sequence A (PRE-FLOW). Upon completion of sequence A, the WELD sequence will be initiated automatically. The Sequence Control will continue to operate in the WELD sequence until the contactor control switch is opened. Opening this switch will extinguish the WELD sequence and initiate sequence E (POST-FLOW gas and coolant time).

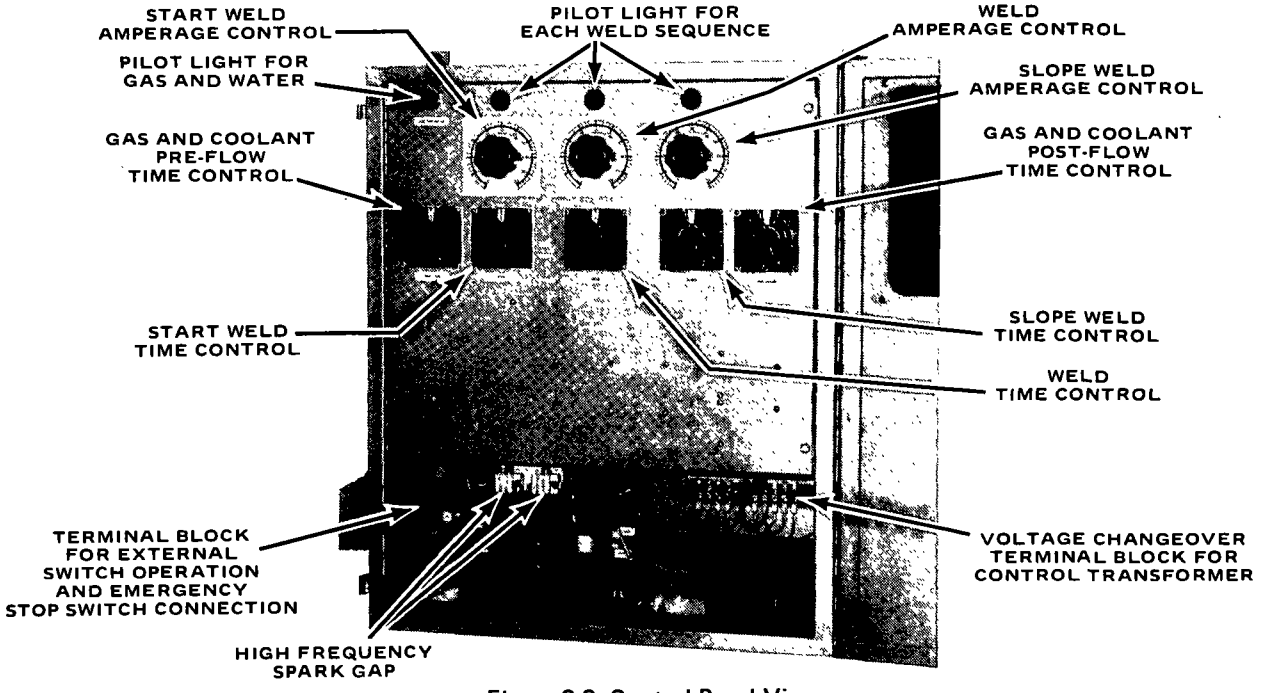

Figure 3-2. Control Panel View

3-5. MANUAL CONTROL OF SEQUENCE C

Provisions are provided for manual timing of sequence C to allow continuous welding for any desired time. This is accomplished by connecting an external switch into the circuit. Refer to Section 2-7 for information on connecting the external switch. The Sequence Control functions automatically through sequences A and B, but the time duration of sequence C is controlled by the external switch. Closing the external switch will extinguish sequence C and initiate the SLOPE weld time (sequence D).

3-6. HIGH-FREQUENCY CONTROL (Figure 2-2)

The high frequency is controlled through the Direct-Air coupling jumper links and the HIGH-FREQUENCY switch labeled START-OFF-CONTINUOUS.

A. Direct-Air Coupling

Located on each side of the high-frequency panel are three terminals and one jumper link. The positions of the links are labeled DIRECT and AIR. These links provide facilities for connecting the high-frequency transformer for either direct or air coupling which governs the amount of high-frequency intensity. To increase the intensity, connect both links in the position labeled DIRECT. To decrease the intensity, connect both links in the position labeled AIR. This unit was shipped with the links connected in the DIRECT position.

B. Off Position

With the switch in the OFF position, high frequency is removed from the weld circuit. This position must be used for Shielded Metal-Arc Welding (SMAW).

C. Start Position

With the switch in the START position, high frequency is induced into the weld circuit as an aid in starting the arc. When a welding arc is established, the high frequency will automatically shut off. This method is recommended for DC Gas Tungsten-Arc Welding (GTAW).

D. Continuous Position

With the switch in the CONTINUOUS position, high frequency is induced into the weld circuit during all three welding sequences, or as long as the contactor is energized. This method is recommended for AC Gas Tungsten-Arc Welding (GTAW).

SECTION 4 - SEQUENCE OF OPERATION

4-1. GAS TUNGSTEN-ARC WELDING (GTAW)

For Gas Tungsten-Arc Welding (GTAW), check and adjust the controls as follows:

1. Check that shielding gas and coolant connections are as described in Sections 2-3 and 2-4.
2. Check that secondary connections are as described in Section 2-2.
3. Determine the type of welding current required (AC, DCSP, or DCRP), and position the Polarity switch or Selector switch on the welding power source accordingly.
4. Place the Range switch on the welding power source in the desired current range.
5. Rotate the AMPERAGE ADJUSTMENT control on the welding power source to the maximum position.
6. Rotate the START weld amperage control, WELD amperage control, and the SLOPE weld amperage control on the Sequence Control to the desired setting.
7. Place the WELD switch in the desired position. The AUTOMATIC position is generally used, but the MANUAL position may be employed.
8. On SCE/SCM-1A Models, place the START switch in the desired position according to the welding application.
9. Place the HIGH-FREQUENCY switch in the START position for dc welding, and in the CONTINUOUS position for ac welding.
10. Adjust the shielding gas and coolant pre-flow and post-flow timers for the desired time setting.
11. Select the proper size tungsten for the welding application from Table 4-1.
12. Connect a normally-open switch into the CONTACTOR CONTROL receptacle.

CAUTION

Prior to welding, it is imperative that proper protective clothing (welding coat and gloves) and eye protection (glasses and welding helmet) be put on. Failure to comply may result in serious and even permanent bodily damage.

13. Place the POWER switch on the welding power source in the ON position.
14. Close the contactor control switch and commence welding.
15. Readjust the controls as necessary for proper welding condition.

4-2. SHIELDED METAL-ARC WELDING (SMAW)

For Shielded Metal-Arc Welding (SMAW) check and adjust the controls as follows:

1. Disconnect or shut off the shielding gas and coolant supplies.
2. Check that secondary connections are as described in Section 2-2.
3. Determine the type of welding current required (AC, DCSP or DCRP), and position the Polarity switch or Selector switch on the welding power source accordingly.
4. Place the Range switch on the welding power source in the desired current range.
5. Rotate the AMPERAGE ADJUSTMENT control on the welding power source to the maximum position.
6. Rotate the WELD amperage control (sequence C) on the Sequence Control for the approximate percentage of weld current desired within the range selected on the welding power source.
7. Place the WELD switch in the MANUAL position.
8. On SCE/SCM-1A Models, adjust the START weld amperage control to approximately the same setting as the WELD amperage control setting.
9. On SCE/SCM-1A Models, place the START switch in the desired position according to the welding application.
10. Place the HIGH-FREQUENCY switch in the OFF position.
11. Connect a normally-open switch into the CONTACTOR CONTROL receptacle.

CAUTION

Prior to welding, it is imperative that proper protective clothing (welding coat and gloves) and eye protection (glasses and welding helmet) be put on. Failure to comply may result in serious and even permanent bodily damage.

12. Place the POWER switch on the welding power source in the ON position.

13. Close the contactor control switch and commence welding.

14. Readjust the controls as necessary for proper weld condition.

4-3. SHUTTING DOWN

1. Break the arc.

2. Allow the welding power source to idle for 3 minutes with no load applied.

3. Place the POWER switch in the OFF position.

4. Turn off the shielding gas supply if used.

CAUTION

If welding is performed in a confined area, failure to turn off the gas supply could result in a buildup of gas fumes, endangering personnel reentering the welding area.

Table 4-1
Guide For Selecting Electrode For Gas Tungsten-Arc Welding

PURE TUNGSTEN	CURRENT RANGE		
Electrode Dia. (In.)	ACHF-Argon	DCSP-Argon	DCSP-Helium
.010	Up to 15	Up to 15	Up to 20
.020	10 to 30	15 to 50	20 to 60
.040	20 to 70	25 to 70	30 to 90
1/16	50 to 125	50 to 135	60 to 150
3/32	100 to 160	125 to 225	140 to 250
1/8	150 to 210	215 to 360	240 to 400
5/32	190 to 280	350 to 450	390 to 500
3/16	250 to 350	450 to 720	500 to 800
1/4	300 to 500	720 to 990	800 to 1100
1% AND 2% THORIATED TUNGSTEN			
.010	Up to 20	Up to 25	Up to 30
.020	15 to 35	15 to 50	20 to 60
.040	20 to 80	25 to 80	30 to 100
1/16	50 to 140	50 to 145	60 to 160
3/32	130 to 250	135 to 235	150 to 260
1/8	225 to 350	225 to 360	250 to 400
5/32	300 to 450	360 to 450	400 to 500
3/16	400 to 550	450 to 720	500 to 800
1/4	500 to 800	720 to 990	800 to 1100

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SECTION 5 - MAINTENANCE

CAUTION

Placing the POWER switch in the OFF position does not remove power from all of the welding power source internal circuitry. Completely terminate all electrical power to the welding power source by employing "machinery lockout procedures" before attempting any inspection or work on the inside of the welding power source or the Sequence Control. If the welding power source is connected to a disconnect switch, padlock the switch in an open position. If connected to a fuse box, remove the fuses and padlock the cover in the closed position. If the unit is connected to a circuit breaker, or other disconnecting device without locking facilities, attach a red tag to the device to warn others that the circuit is being worked on.

5-1. HIGH VOLTAGE CAPACITORS

These parts are rarely a source of trouble. Any local radio repair shop can readily determine the condition of the capacitors. If one of the high voltage capacitors fail, operation may be continued with one capacitor until a new one can be secured. To prevent excessive overload on the remaining single capacitor, the spark gap point setting should be reduced to about .004 inches.

5-2. SPARK GAP ADJUSTMENT (Figure 5-1)

The spark gaps can readily be inspected by opening the door of the Sequence Control. The spark gaps are set at .008 inches when shipped. It will be necessary to periodically readjust these after extended operation. Usually, inspection and adjustment every three to four months will suffice. Readjustment is indicated when intermittent operation of the gaps is noted. Usually this occurs when the gap setting has increased to .012 inches or greater.

The high-frequency output varies directly (up to a certain point) with the spark gap spacing. In extreme cases where the greatest amount of high frequency is needed, it may be necessary to adjust the gap setting to .010 inches or greater. This increases the high-frequency radiation; therefore, it is suggested that the minimum gap setting (.008 inches) consistent with good welding operation, be used.

Widening of the spark gaps through normal operation may, if not corrected, increase the loading of the high voltage capacitors and thus contribute to their premature failure. Cleaning or dressing of the point is not recommended as the material at the points is tungsten and is impossible to file. The entire points should be replaced when they become extremely pitted or burned to such an extent that little or no tungsten is left.

To adjust spark gaps proceed as follows:

A. Loosen screws (A) on both sides.

B. Place an .008 inch feeler gauge in spark gap area (C).

C. Apply slight pressure against spark point (B) so feeler gauge is held firmly between the two points.

D. Tighten screws (A).

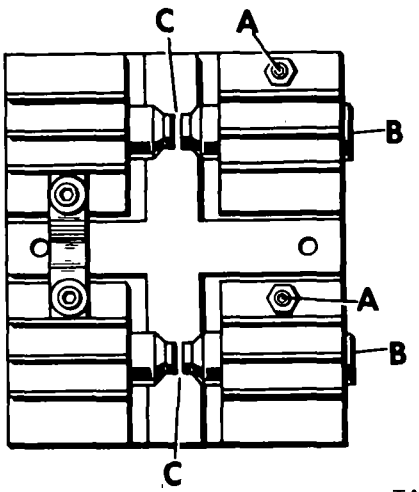

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Figure 5-1. Spark Gap Adjustment

5-3. BYPASS PANEL

The purpose of the bypass panel is to reduce the high-frequency feedback into the transformer of the welding power source. A defective capacitor in this circuit would reduce high-frequency output, and might be evident by loss of oil from the capacitor case. If in doubt as to the condition of the capacitors, have them checked at a radio repair shop. The resistors in the circuit would show evidence of failure if they are cracked. Failure in this circuit is rare, and would be suspected only as a last resort.

5-4. CONTROL CIRCUIT PROTECTION

The Sequence Control is equipped with fuses protecting the control circuit components. The diagram markings and quantity of fuses may vary depending on the model. Normally the fuses can be easily inspected by opening the cabinet door and examining the interior of the unit. Consult the circuit diagram at beginning of welding power source Owner's Manual for specific information on this unit. The proper information about specific fuses can be determined from the Parts List.

SECTION 6 - TROUBLESHOOTING

CAUTION

Hazardous voltages are present on the internal circuitry of this unit as long as power is connected. Disconnect power before attempting any inspection or work on the inside of the unit. Troubleshooting of internal circuitry should be performed by qualified personnel only.

The following chart is designed to diagnose and provide remedies for some of the troubles that may develop in this unit.

It is assumed that proper installation has been made, according to Section 2 of this manual, and that the unit has been functioning properly until this trouble developed.

Use this chart in conjunction with the circuit diagram while performing troubleshooting procedures. If the trouble is not remedied after performing these procedures, the nearest Factory Authorized Service Station should be contacted. In all cases of equipment malfunction, the manufacturer's recommendations should be strictly followed.

TROUBLE	PROBABLE CAUSE	SUGGESTED CHECK AND/OR REMEDY
All sequences inoperative; no output. Gas and coolant flows for a brief period and then shuts off (transformer T1 is energized).	Fuse F6 open.	*Replace fuse F6 (see Section 5-4).
	Remote Hand Switch not tight in receptacle RC1.	Ensure that Remote Hand Switch is secure in receptacle RC1.
All sequences inoperative; no output. Gas and coolant does not flow (transformer T1 is energized).	Fuse F7 open.	*Replace fuse F7 (see Section 5-4).
Sequence Control entirely inoperative (transformer T1 not energized).	Fuse F8 open.	*Replace fuse F8 (see Section 5-4).
Normal output; no high frequency.	High-frequency switch in OFF position.	Place high-frequency switch in proper position.
	Incorrect spark gap.	Check spark gap. Adjust as required. See Section 5-2.
	Shorted high voltage capacitor(s).	Replace capacitor(s).
Normal output. Low high frequency.	Incorrect spark gap.	Check setting for .008 inch. See Section 5-2.
	High-frequency leaks.	Check all connections for high-frequency leaks.
	Incorrect direct-air coupling.	Check that both links are connected for the same coupling.
Erratic weld current.	Poor tungsten.	Check tungsten and replace if contaminated.
	Incorrect polarity.	Check polarity.
	Incorrect welding cable size or loose connections.	Check for proper weld cable size (see Section 2-2). Tighten all welding cable connections.
	Poor ground at workpiece.	Check ground connections.
Contactor pulls in.	Incorrect operating voltage of relay CR3.	Adjust slider on resistor R2 so relay CR3 pulls in on open-circuit voltage.
Weld current does not shut off.	Incorrect operating voltage of relay CR3.	Adjust slider on resistor R2 so relay CR3 drops out when welding arc is initiated.
Contactor does not pull in.	Blown fuses F6 and/or F7 in control circuitry.	*Replace fuses F6 and/or F7 (see Section 5-4).

*If it becomes necessary to replace any fuse in this unit, ensure that a fuse of the proper size is used.

NOTE

See beginning of welding power source Owner's Manual for circuit diagram.

SECTION 7 - CERTIFICATION FOR HIGH FREQUENCY ARC WELDING EQUIPMENT

7 - 1. GENERAL

This following information is necessary to make a proper installation of the high frequency arc welding equipment described in this instruction manual. In order to comply with Part 18 of the Rules and Regulations of the Federal Communications Commission, the certificate in front of this manual must be filled in completely and signed. The certificate must be kept WITH THE EQUIPMENT AT ALL TIMES to comply with the regulation.

The manufacturer of the equipment covered herein has conducted approved field tests and certifies that the radiation can reasonably be expected to be within the legal limits if the correct installation procedures, as outlined, are followed.

The importance of a correct installation cannot be overemphasized since case histories of interference due to high frequency stabilized arc Welding Machines have shown that invariably an inadequate installation was at fault.

The user of the equipment must complete the certification by stating that he has installed the equipment and is using it, according to the manufacturer's instructions. The user must sign the certification notice appearing in front of this instruction booklet indicating that he has complied with the requirements.

In the event that interference with authorized services occurs, in spite of the fact that the radiation from the welding equipment is within the specified limits, the user is required to take suitable steps to clear the situation. The factory personnel will assist the user by supplying technical information to clear the situation.

In lieu of complying with the installation requirements and the certification of each individual installation, the user may elect to certify his entire plant by having a reputable engineering firm make a plant radiation survey. In such cases, the installation instructions incorporated in this instruction booklet could very well serve as a guide in minimizing interference that might be contributed by the high frequency arc welding equipment.

7 - 2. GENERAL INFORMATION

In a high frequency stabilized arc Welding Machine installation, interfering radiation can escape in four distinct ways as outlined below:

1. Direct radiation from the welding machine. This is radiation that escapes directly from the Welding Machine case. This is very pronounced if access doors are left open and unfastened and if the Welding Machine case is not properly grounded. Any opening in the metal Welding Machine case will allow some radiation to escape. The high frequency unit of this certified equipment is adequately shielded to prevent direct radiation of any consequences if proper grounding is carried out.

2. Direct feedback to the power line. High frequency energy may get on the power line by direct coupling inside the equipment or the high frequency unit, the power line then serving as a radiating antenna.

   By proper shielding and filtering, direct coupling is prevented in this certified equipment.

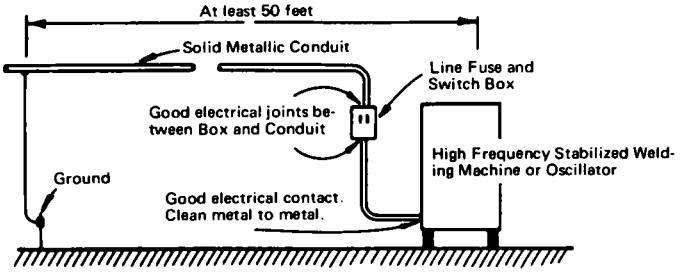


Figure 7-1. Power Service Installation H. F. Stabilized Arc Welding Machine

3. Direct radiation from welding leads. Direct radiation from the welding leads, although very pronounced, decreases rapidly with distance from the welding leads. By keeping the welding leads as short as possible, the operator can do a great deal to minimize interference from the source.

   The intensity and frequency of the radiation can be altered over wide limits by changing the location and relative position of the welding leads and work. If possible, loops and suspended sections should be avoided.

4. Pick-up and reradiation from power lines. Even though welding lead radiation falls off rapidly with distance, the field strength in the immediate vicinity of the welding area may be extremely high. Unshielded wiring and ungrounded metallic objects in this strong field may pick up the direct radiation, conduct the energy for some distance, and produce a strong interference field in another area.

   This is usually the most troublesome source of interference, but careful adherences to proper installation procedure as outlined in this booklet will minimize this type of interference.

7 - 3. POWER SERVICE

The specific installation instructions for making the proper primary connections to the equipment as outlined in the instruction booklet furnished with the equipment, should be followed carefully with one exception as notted in the following paragraph.

Frequently installation instructions specify that the primary power service shall be run in solid or flexible metallic conduit. Ordinary helically wrapped conduit is designed for mechanical protection and is not suitable for electrical shielding. Only solid metallic conduit or conduit of "equivalent electrical shielding ability" should be used to enclose the primary power service leads.

Solid metallic shielding shall enclose the primary power service to the equipment from a point 50 feet from the equipment in a unbroken run.

This shielding shall be grounded at the farthest point from the equipment and should make good electrical contact with the casing of the equipment. The ground should be in accordance with the specifications outlined in the section entitled "GROUNDS" and as shown in Figure 7-1. Care should be taken that paint or corrosion at the junction of conduit and case, does not interfere with good electrical contact.

There shall be no gap in this shielding run. This simply means that within 50 feet of the equipment, no portion of the power wires serving the equipment shall be unshielded. If there is any question about the electrical efficiency of the joints between individual conduit sections, outlet boxes and the equipment case, bonding should be carried out by soldering a copper strap or wire across the joint as shown in Figure 7-2.

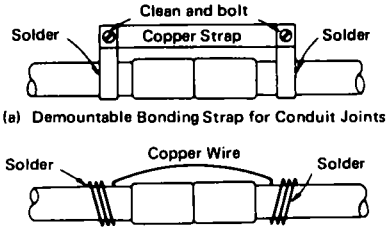


Figure 7-2. Two Recommended Methods For Electrical Bonding Across Poor Conductivity Conduit Joints

7 - 4. WELDING MACHINE

The location of the equipment should be chosen with respect to nearness to a suitable ground connection. The equipment case, firmly bonded to the power conduit, should be grounded to the work terminal of the equipment with a copper cable or braid with rated current carrying capacity equal to or greater than that of the power service wires.

This "work" output terminal of the equipment should then be grounded to a "good electrical ground" (as defined in section entitled "GROUNDS") with a short length of welding cable of the same capacity as the "work lead". (See Figure 7-3).

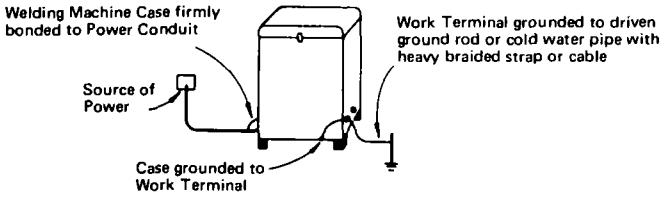


Figure 7-3. Ground Connections At Welding Machine

No change in the wiring or the location of parts inside the equipment, other than power service tap changes or other adjustments specifically covered shall be made. The equipment shall not be modified in any way since changes in the equipment can affect the radiation characteristics and may not be in accordance with the test data upon which the manufacturer bases his certification.

While the equipment is in operation, all access and service doors shall be closed and properly fastened.

Spark gap settings shall be maintained at the minimum separation consistent with satisfactory welding results.

7 - 5. WELDING LEADS

In order to minimize direct weld lead radiation, the welding leads (electrode lead and work lead) must be kept as short as possible. Certification tests on this machine have been made with leads 25 feet long. Considerable improvement in radiation minimization can be had by shortening the leads as much as possible.

Keeping the electrode lead and ground or work lead as close as possible and on the floor serves to reduce the radiation. (See Figure 7-4).

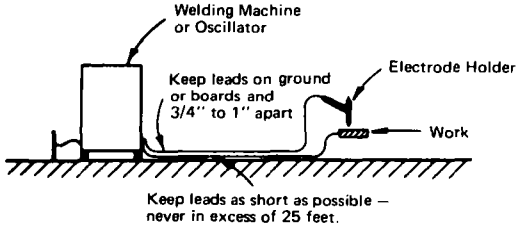


Figure 7-4. General Rules For Welding Leads

7 - 6. WIRING IN THE VICINITY OF THE WELDING AREA

As discussed in the general information section, the most serious source of interference is reradiation from wires that are located near the welding area.

Any ungrounded electrical conductor in the strong "directly radiated" field, produced by the welding leads, serves as a pick-up device and may conduct the interference for some distance and reradiate strongly at another location.

For purpose of simplification and standardization, the space all around the weld zone at a distance of 50 feet in all directions is referred to as the High Field Intensity (H.F.I.) zone. (See Figure 7-5).

To minimize radiation of this type all wiring in the H.F.I. zone shall be in rigid metallic conduit, lead covered cable, copper braid or material of equivalent shielding efficiency. Ordinary flexible helically wrapped metallic conduit, commonly referred to as "B.X." is not satisfactory for shielding, and should not be used. The shield on all wiring should be grounded at intervals of 50 feet and good electrical bonding between sections shall be maintained.

This shielding requirement applies to all wiring, including telephone, inter-communication, signal and control and incidental service.

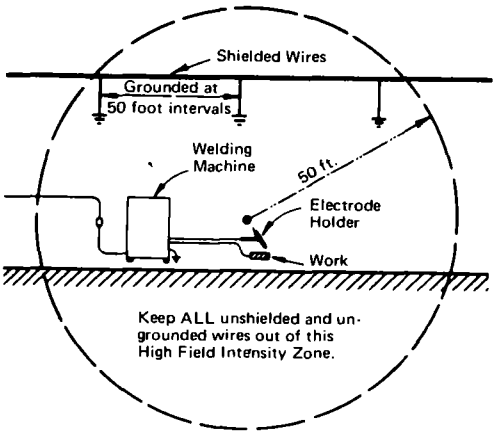


Figure 7-5. General Requirements To Minimize Reradiation Pick-Up In the Vicinity of the Weld Zone

Extreme precaution should be taken to make sure that the location of the zone is chosen so that none of the conditions are voided by unshielded wires off the premises but still within the radial dimensions of the H.F.I. zone.

This 50 foot H.F.I. zone is a minimum that is imposed on the installation. Certification tests by the manufacturer are based on this limit.

Keeping unshielded wires farther than 50 feet from the weld zone will materially aid in minimizing interference.

If it is impossible to relocate unshielded wires, that section within the H.F.I. zone, should be placed in conduit and each end of the conduit section grounded.

NOTE

It must be emphasized that all changes in power and lighting wiring should be made by a qualified electrician and comply with the National Electrical Code requirements. Any shielding or relocation of telephone or signal wires must be done either by the service company concerned or with the specific permission of said company.

7 - 7. GROUNDS

Frequent reference is made to a "good ground" in previous sections. Although there is considerable leeway in the interpretation of this term, for the purpose covered in this booklet the following specifications apply:

A "ground" connection should be made to a driven rod at least 8 feet long and driven into moist soil.

A cold water pipe can be used in place of the ground rod provided it enters the ground within 10 feet of the equipment to be grounded.

All leads connecting the point to be grounded to the ground rod or pipe should be as short as possible since the ground lead itself can become an effective radiating antenna.

The effectiveness of a ground in reducing interference depends upon the ground conductivity. In certain locations it may become necessary to improve the ground conductivity by treating soil around the ground rod with a salt solution.

7 - 8. METAL BUILDING

It is frequently through that operating of high frequency stabilized arc welding equipment in metallic buildings will completely eliminate troublesome radiation. This, however, is a false assumption.

A metallic building structure, if properly grounded, may serve to reduce direct radiation from the weld zone but will have no effect on conducted interference and reradiation. As a result, all installation requirements necessary for certification must be complied with.

If the metallic building is not properly grounded, bonding to several good electrical grounds placed around the periphery of the building will give reasonable assurance that the building itself is not contributing to the radiation.

7 - 9. INDIVIDUAL INSTALLATION CERTIFICATION

Any or all of the above installation requirements may be waived by the user if he desires to exercise the option of making an individual field survey of the particular unit installation (or the complete installation if more than one unit is involved), and certifying on that basis.

This survey shall be made by a competent engineer in accordance with the test procedure requirements as set forth in Part 18 of the Rules and Regulations of the Federal Communications Commission.

Surveys of this nature can cover a single unit or multiple units or may include the complete plant structure.

7-10. CHECK LIST

The following questions may be used by the installer as a check to see if all installation requirements have been met:

1. Has the equipment been located so that ground leads can be kept short?
2. Are the power leads, serving the unit, in conduit?
3. Is there good electrical contact between power conduit and case?
4. Do the conduit couplings make good electrical contact? (If in doubt, use bonding).
5. Is there good electrical contact between conduit and switch on service boxes?
6. If rigid metallic conduit is not used, is the shielding used of equivalent shielding efficiency? (Copper sleeving, lead covered cable, etc., is satisfactory. Spirally wound flexible metallic conduit is not suitable).
7. Is the conduit system grounded at a point at least 50 feet from the equipment?
8. Is the conduit run complete (without any gap) in the H.F.I. zone?
9. Is the equipment case connected to the work terminal of the secondary?
10. Is the wire used for this connection of sufficient size?
11. Is the work terminal connected to a good electrical ground?
12. Is the cable or copperbraid used for this connection equal to or greater in current carrying capacity than the welding lead?
13. Is this cable as short as possible?
14. Are the spark-gaps set at .008" or less?
15. Are all service and access doors closed and bolted?
16. Are the welding leads less than 25 feet long?
17. Are they as short as possible?
18. Are the welding leads on the floor or placed on a suitable board?
19. Are the welding leads approximately 3/4" to 1" apart?
20. Have you visualized the H.F.I. zone, a sphere with a 50 foot radious centered on the weld zone?
21. Have the unshielded power and light wires originally in this H.F.I. zone been placed in grounded shields or been relocated outside the zone?
22. Have all large metallic objects and any long guy or supporting wires in the H.F.I. zone been grounded?
23. Have you checked so that no external power or telephone lines off the premises are within the zone?
24. Are the grounds driven ground rods?
25. Is a cold water pipe used as ground?
26. If so, does it enter the ground 10 feet or less from the connection?
27. Are the connections to the ground clean and tight?
28. If operated within a metal building, is the building properly grounded?

If your answer is "yes" to the above questions, you can certify the installation by signing the certificate.

February 1980 FORM: OM-540A

Effective With Serial No. HK321565

MODEL
SCE-1A
SCE-3A
SCE-5A
SCM-1A
SCM-3A
SCM-5A

PARTS LIST

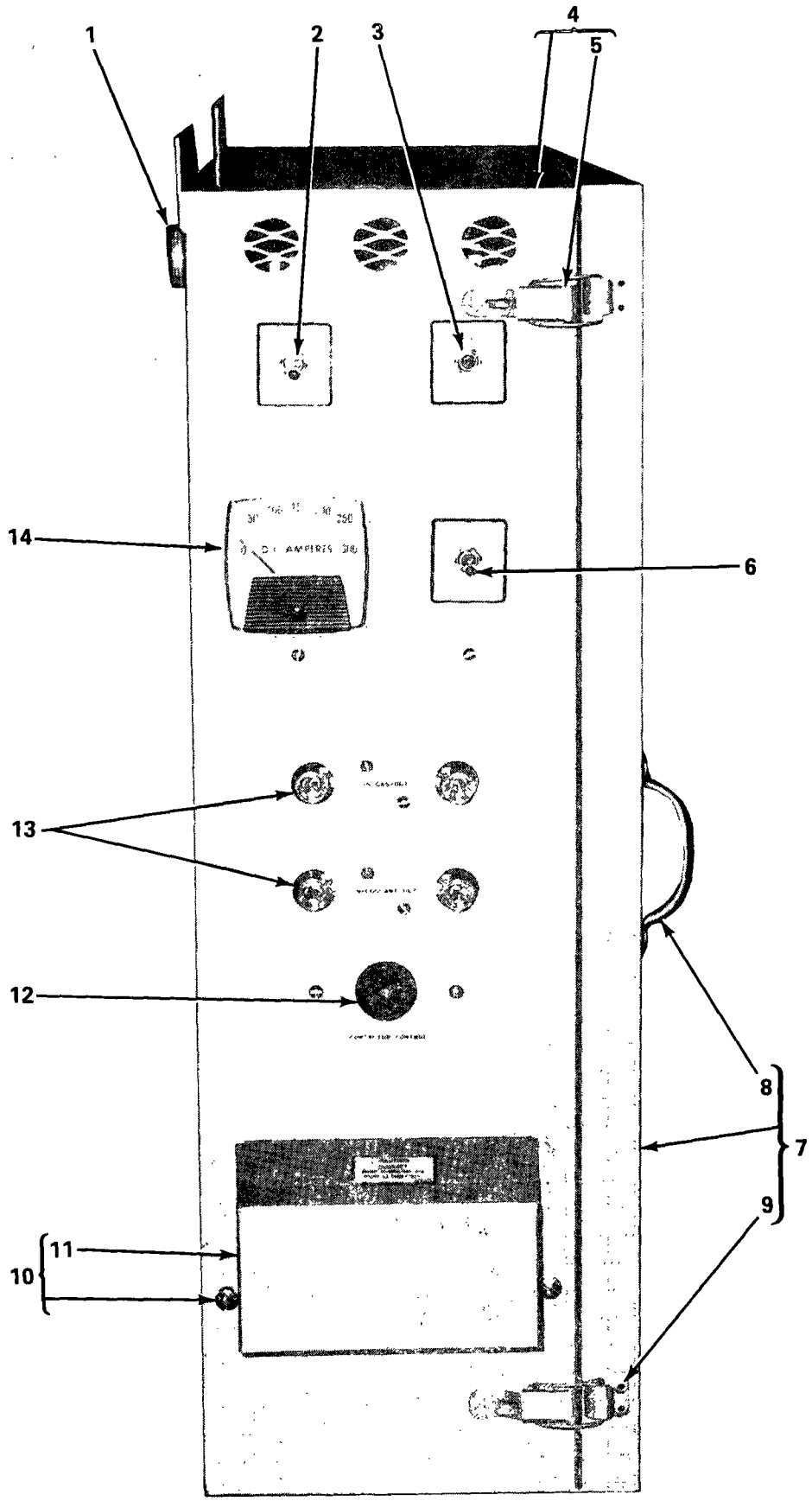


Figure A - Left Side View

Item No.	Dia. Mkgs.	Factory Part No.	Description	SCE Or SCM	Quantity Model 1A	3A	5A
Figure A			**Left Side View**				
1		601 156	NIPPLE, chase 1-1/4 thick	Both	1	1	1
		601 152	NUT, locking 1-1/4 inch	Both	1	1	1
2	S1	011 624	SWITCH, toggle 4PDT 15 amp 125 volts	Both	1	1	1
3	S3	011 610	SWITCH, toggle SPDT 10 amp 125 volts	Both	1	1	
3	S2	011 610	SWITCH, toggle SPDT 10 amp 125 volts	Both			1
4		028 872	CABINET, w/o door & component mtg. panel (consisting of)	Both	1	1	1
5		026 421	. CATCH, door	Both	2	2	2
		023 220	BRACKET, support (SCE/SCM to machine)	Both	1	1	
6	S2	011 609	SWITCH, toggle SPDT 15 amp 125 volts	Both	1		
7		020 916	DOOR (consisting of)	Both	1	1	1
8		019 677	. HANDLE, door - pull	Both	1	1	1
9		026 420	. STRIKE, catch door	Both	2	2	2
		013 442	WINDOW, plexiglass	Both	1	1	1
10		028 868	COVER, terminal board (consisting of)	Both	1	1	1
11		604 768	. FASTENER, SC 1/4 turn No. 5	Both	2	2	2
		602 344	. RETAINER, screw	Both	2	2	2
		018 851	PLATE, cover - opening terminal	Both			1
		602 347	RECEPTACLE, rivet - type screw 1/4 turn	Both	2	2	2
12	RC1	035 493	RECEPTACLE, twistlock - grounded 3P3W	Both	1	1	
12	RC2	035 493	RECEPTACLE, twistlock - grounded 3P3W	Both			1
13	GS1, WS1	003 538	VALVE, 115 volts ac 2 way 1/4 IPS port (consisting of)	Both	2	2	2
		003 539	. COIL, valve 115 volts ac	Both	1	1	1
		010 295	FITTING, hose - brass elbow male 1/4 NPT x 5/8-18 LH (coolant)	Both	2	2	2
		010 296	FITTING, hose - brass elbow male 1/4 NPT x 5/8-18 LH (gas)	Both	2	2	2
14	A	025 603	METER, amp dc 50MV 0-300 scale or				
14	A	025 608	METER, amp dc 50MV 0-500 scale or				
14	A	025 611	METER, amp dc 50MV 0-600 scale or				
14	A	025 610	METER, amp dc 50MV 0-800 scale	Both	1	1	
14	A	025 625	METER, amp ac 0-300 scale or				
14	A	025 617	METER, amp ac 0-500 scale or				
14	A	025 621	METER, amp ac 0-600 scale or				
14	A	025 618	METER, amp ac 0-800 scale	Both		1	
14	A	025 617	METER, amp ac 0-500	Both			1
	P1	025 701	FILTER, high frequency	Both	1	1	1

BE SURE TO PROVIDE MODEL AND SERIAL NUMBERS WHEN ORDERING REPLACEMENT PARTS.

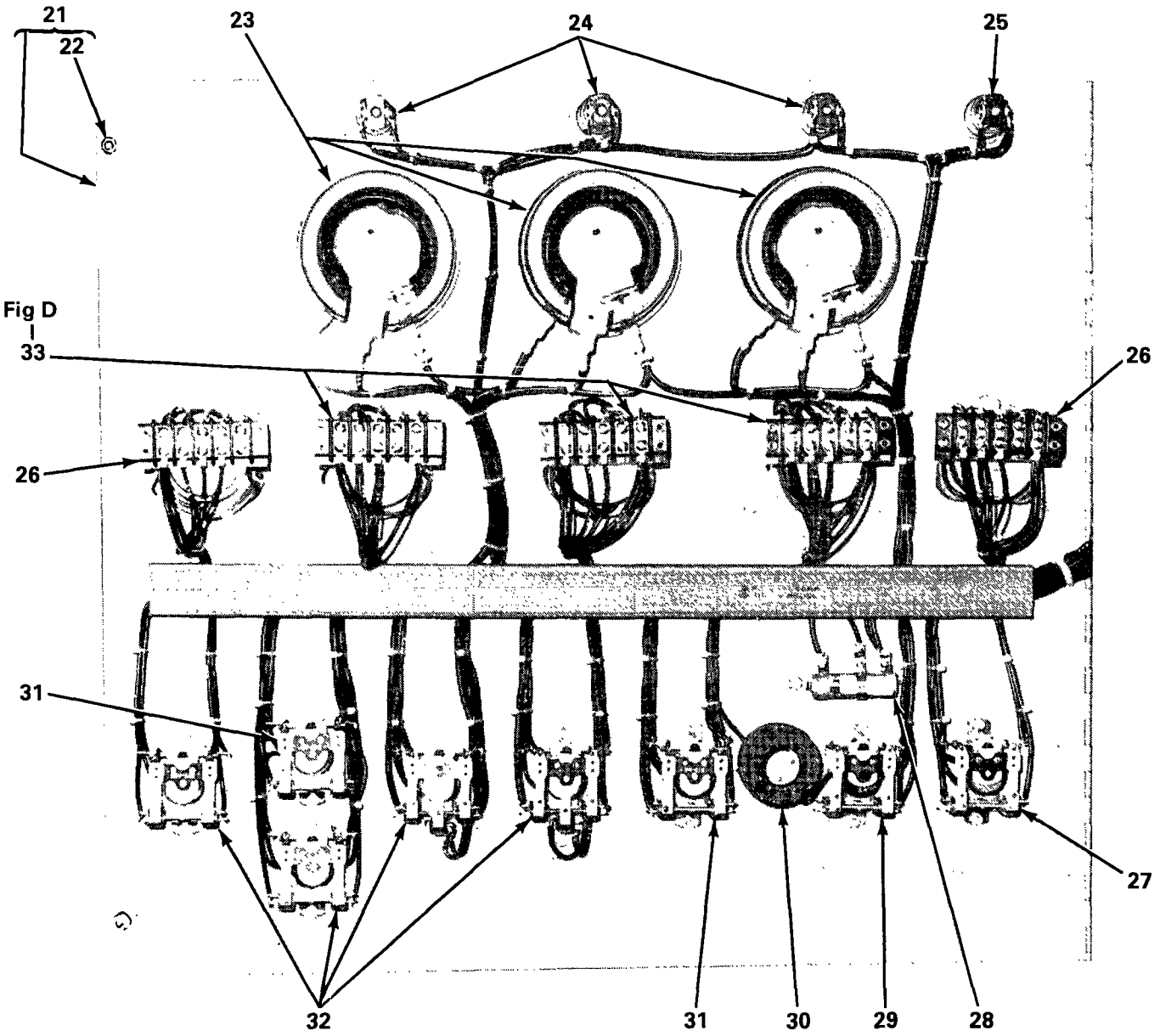


Figure B - Panel, Mounting W/Components

Item No.	Dia. Mkgs.	Factory Part No.	Description	SCE Or SCM	Quantity Model 1A	3A	5A
Figure B			**Panel, Mounting W/Components**				
21		020 918	PANEL, mounting - components (consisting of)	SCE	1		
21		030 922	PANEL, mounting - components (consisting of)	SCM	1		
21		020 920	PANEL, mounting - components (consisting of)	SCE		1	
21		020 924	PANEL, mounting - components (consisting of)	SCM		1	
21		020 921	PANEL, mounting - components (consisting of)	SCE			1
21		020 925	PANEL, mounting - components (consisting of)	SCM			1
22		010 853	. FASTENER, screw - slotted hd No. 2	Both	2	2	2
		010 855	. RETAINER, screw No. 2	Both	2	2	2
23	R3-5	030 653	RHEOSTAT, WW 150 watt 15 ohm	Both	3	3	
23	R23-25	030 653	RHEOSTAT, WW 150 watt 15 ohm	Both			3
		019 627	KNOB, pointer 1/4 bore	Both	3	3	3
24	PL1-3	027 603	LIGHT, indicator - red lens 6-125 volts ac	Both	3	3	3
25	PL4	027 601	LIGHT, indicator - green lens 6-125 volts ac	Both	1	1	1
		027 602	BULB, incandescent base 120 volts	Both	4	4	4
26	TD1,5	034 703	TIMER, 15 second 115 volts or				
26	TD1,5	034 704	TIMER, 1 minute 115 volts or				
26	TD1,5	034 705	TIMER, 3 minute 115 volts or				
26	TD1,5	034 706	TIMER, 5 minute 115 volts	Both	2	2	2
27	CR1	034 619	RELAY, 24 volts ac DPDT	Both	1	1	
27	CR1	034 666	RELAY, 24 volts ac 3PDT	Both			1
28	R2	030 617	RESISTOR, WW adj 25 watt 2000 ohm	Both	1	1	
28	R21,22	030 617	RESISTOR, WW adj 25 watt 2000 ohm	Both			2
29	CR3	034 601	RELAY, 24 volts dc DPDT	Both	1	1	
29	CR3	034 607	RELAY, 110 volts dc 3PDT				1
30	RFC	033 609	CHOKE, filter 2 amp 6 ohm	Both	1		
31	CR2,8	034 615	RELAY, 115 volts ac DPDT	Both	2	2	
32	CR5,6, 7,9	034 613	RELAY, 115 volts ac 3PDT	Both	4	4	
33	TD2-4	034 703	TIMER, 15 second 115 volts ac or				
33	TD2-4	034 704	TIMER, 1 minute 115 volts ac or				
33	TD2-4	034 705	TIMER, 3 minute 115 volts ac or				
33	TD2-4	034 706	TIMER, 5 minute 115 volts ac	SCM	3	3	3
33	TD2-4	047 277	TIMER, delay 2 sec or				
33	TD2-4	047 278	TIMER, delay 5 sec or				
33	TD2-4	046 157	TIMER, relay 15 sec or				
33	TD2-4	046 158	TIMER, relay 25 sec or				
33	TD2-4	047 279	TIMER, delay 50 sec (Fig D Pg 7)	SCE	3	3	3

BE SURE TO PROVIDE MODEL AND SERIAL NUMBERS WHEN ORDERING REPLACEMENT PARTS.

Item No.	Dia. Mkgs.	Factory Part No.	Description	SCE Or SCM	Quantity Model 1A	3A	5A
Figure C			**Interior Cabinet View**				
41	CR4	034 615	RELAY, 115 volts ac 2PDT	Both	1	1	
42	1T	038 639	BLOCK, terminal 30 amp 6 pole	Both	1		
42	1T	038 622	BLOCK, terminal 30 amp 5 pole	Both		1	
42	1T	038 646	BLOCK, terminal 30 amp 10 pole	Both			1
43	W	034 909	CONTACTOR, 4 pole 115/230 volts ac (Fig F Pg 9)	Both	1		
		034 912	INTERLOCK, contactor - normally open	Both	1		
44	F8	012 639	FUSE, cartridge 6 amp 600 volts	Both	1		
45		012 638	HOLDER, fuse - cartridge 30 amp 600 volts	Both	1		
46		010 854	NUT, speed No. 2	Both	2	2	2
		014 491	BRACKET, door - stop	Both	2	2	2
47	F6	*012 606	FUSE, plug 15 amp 250 volts	Both	1	1	1
		012 640	HOLDER, fuse - plug	Both	1	1	1
48	2T	038 621	BLOCK, terminal 30 amp 4 pole	Both	1		
48	5T	038 639	BLOCK, terminal 30 amp 6 pole	Both		1	
48	2T	038 639	BLOCK, terminal 30 amp 6 pole	Both			1

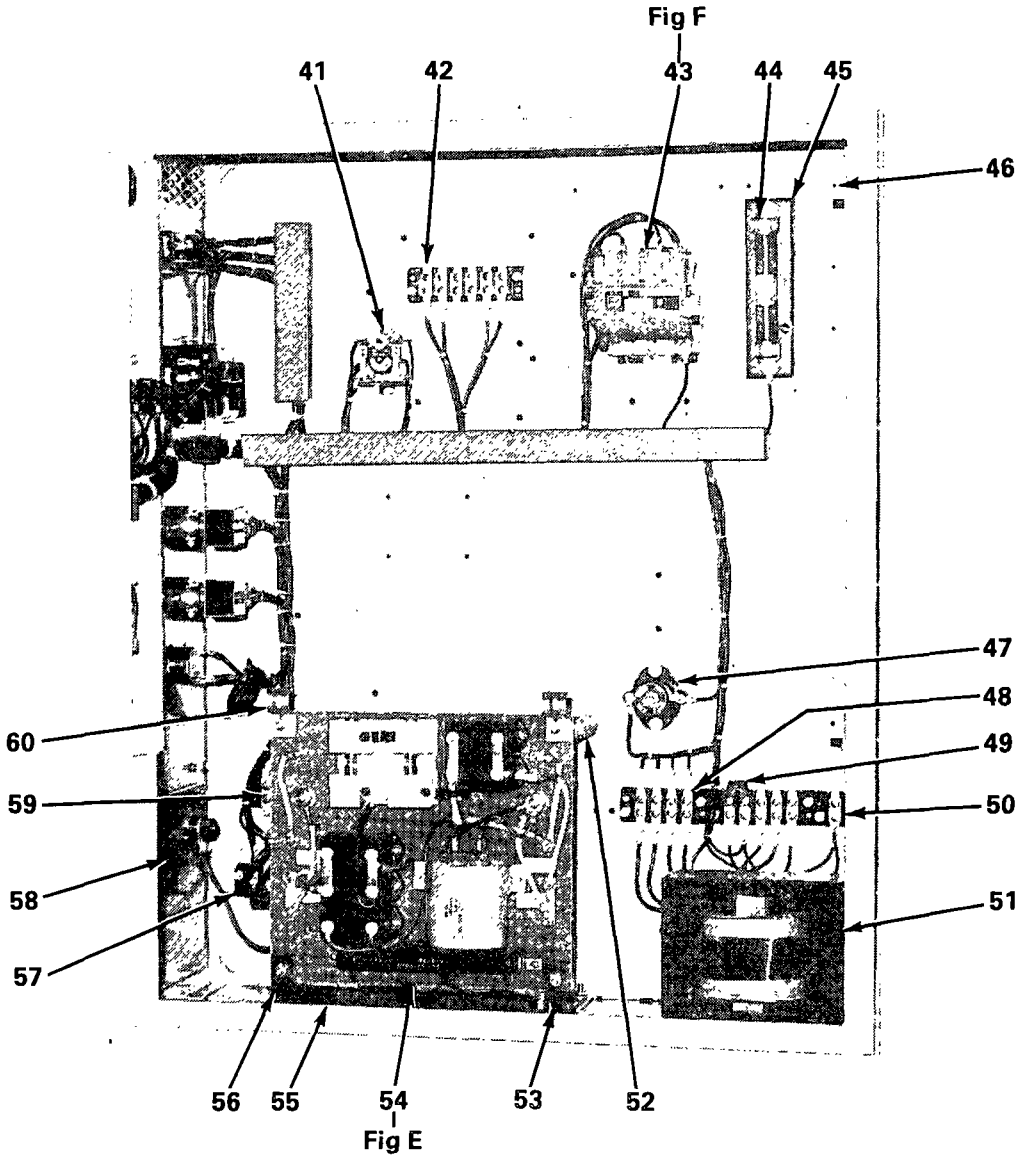
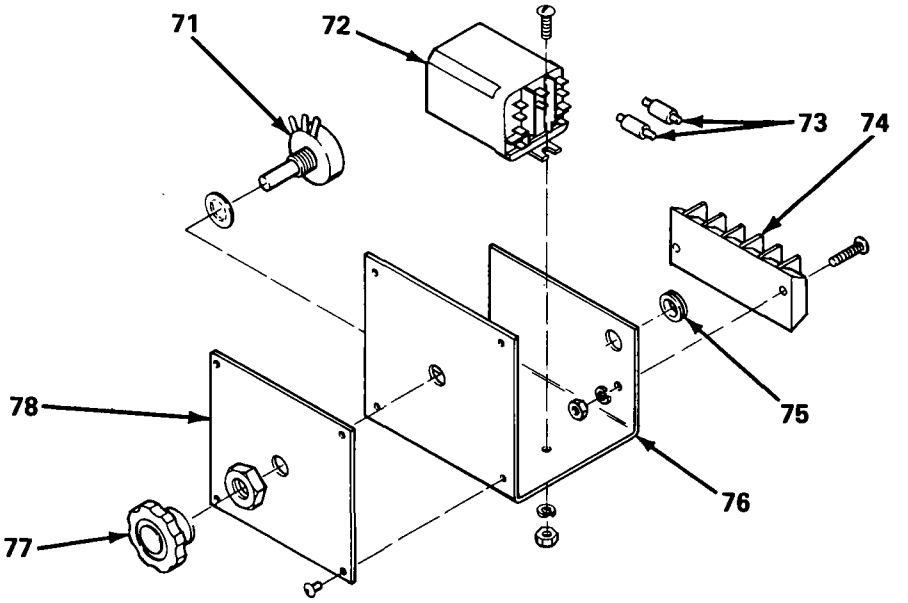


Figure C - Interior Cabinet View

Item No.	Dia. Mkgs.	Factory Part No.	Description	SCE Or SCM	Quantity Model 1A	3A	5A
Figure C			**Interior Cabinet View (Cont'd.)**				
49		038 620	LINK, jumper - terminal block	Both	1	1	
	TE2	038 602	BLOCK, terminal 30 amp 3 pole	Both	1		
	TE2	038 622	BLOCK, terminal 30 amp 5 pole	Both		1	
50	TE3	038 640	BLOCK, terminal 30 amp single pole	Both	1	1	
51	1T	036 618	TRANSFORMER, kva 1/2 30-115 duplex	Both	1		
51	T1	036 629	TRANSFORMER, kva 1/2 15-30-115	Both		1	
52		101 800	TUBING, steel 5/8 OD x 3/8 ID x 5-1/4	Both	2	2	
53		018 849	BRACKET, mounting - RH HF panel	Both	1	1	
54		020 636	HF PANEL (Fig E Pg 8)	Both	1		
54		020 638	HF PANEL (Fig E Pg 8)	Both		1	
55		018 850	ANGLE, mounting - HF	Both	2	2	
56		018 848	ANGLE, mounting - LH HF panel	Both	1	1	
57	4T	038 622	BLOCK, terminal 30 amp 5 pole	Both	1	1	1
58		035 925	TERMINAL ASSEMBLY, power output (consisting of)	Both	1	1	1
		028 865	. TERMINAL BOARD	Both	1	1	1
		038 982	. STUD, brass 1/2-13 x 2-5/8 center drilled	Both	2	2	2
		010 912	. PIN, spring - carbon steel 1/8 x 3/8	Both	2	2	2
		602 247	. WASHER, flat - steel 1/2 SAE	Both	2	2	2
		602 217	. WASHER, lock - external tooth 1/2	Both	2	2	2
		601 840	. NUT, brass - hex jam 1/2-13	Both	6	6	6
		601 839	. NUT, brass - hex full 1/2-13	Both	4	4	4
59	3T	038 602	BLOCK, terminal 30 amp 3 pole	Both	1	1	
59	3T	038 617	BLOCK, terminal 30 amp 2 pole	Both			1
		038 620	LINK, jumper - terminal block	Both	2	2	2
60		601 119	CLIP, jiffy - conduit 1/2 inch	Both	2	2	
	C21-23	031 610	CAPACITOR, electrolytic 40 uf 250 volts dc	Both			3
	C24	031 611	CAPACITOR, electrolytic 5 uf 150 volts dc	Both			1
	CR2,2B, 4,7,8, 13,15, 16	034 615	RELAY, 115 volts ac DPDT	Both			8
	CR2A, 5,6,9	034 613	RELAY, 115 volts ac 3PDT	Both			4
	CR10	034 615	RELAY, 115 volts ac DPDT	SCE	1	1	
	CR10	034 607	RELAY, 110 volts dc 3PDT	Both			1
	CR11	034 601	RELAY, 24 volts dc DPDT	Both			1
	CR12, 14,17	034 612	RELAY, 110 volts dc DPDT	Both			3
	CR18	034 615	RELAY, 115 volts ac DPDT	SCE			1
	F7	*†012 606	FUSE, plug 15 amp 250 volts	Both	1	1	
		†012 602	HOLDER, fuse - plug	Both	1	1	
	R26-29	604 178	RESISTOR, carbon 2 watt 100 ohm	Both			4
	SR3	037 568	RECTIFIER, signal w/mtg. brackets (consisting of)	Both		1	
	SR21-24, 26	037 568	RECTIFIER, signal w/mtg. brackets (consisting of)	Both			5
		102 363	. BRACKET, rectifier - mounting	Both		2	2
		601 242	. INSULATOR, washer - heat sink	Both		2	2
	SR25	037 616	RECTIFIER, selenium	Both			1

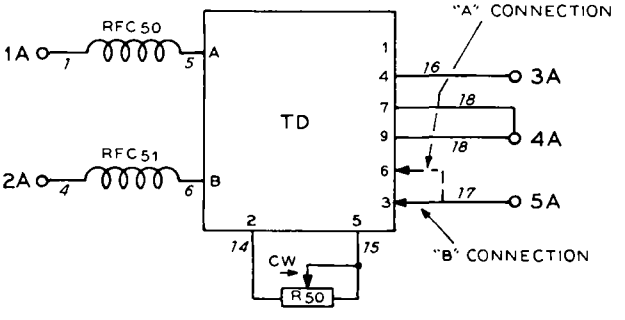
*Recommended Spare Parts.
†Optional Parts.
BE SURE TO PROVIDE MODEL AND SERIAL NUMBERS WHEN ORDERING REPLACEMENT PARTS.

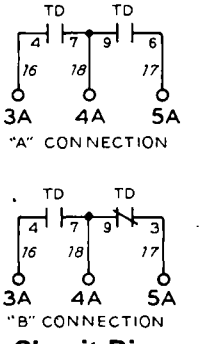
Item No.	Dia. Mkgs.	Factory Part No.	Description	Quantity Model 2 Sec	5 Sec	15 Sec	25 Sec	50 Sec
Figure D			**Timer, Delay (See Fig. B Page 4 Item 33)**	**047 277**	**047 278**	**046 157**	**046 158**	**047 279**
71	R50	030 131	POTENTIOMETER, carbon 1 turn 2 watt 50K ohm	1				
71	R50	030 108	POTENTIOMETER, carbon 1 turn 2 watt 100K ohm		1			
71	R50	028 768	POTENTIOMETER, carbon 1 turn 2 watt 350K ohm			1		
71	R50	030 738	POTENTIOMETER, carbon 1 turn 2 watt 500K ohm				1	
71	R50	028 770	POTENTIOMETER, carbon 1 turn 2 watt 1 meg ohm					1
72		047 133	RELAY, enclosed - time delay 120 volts ac DPDT	1	1	1	1	1
73	RFC50,51	052 978	CHOKE, 5600 UH 45 ohm	2	2	2	2	2
74		038 839	BLOCK, terminal 20 amp 5 pole	1	1	1	1	1
75		010 116	GROMMET, rubber 3/8 ID x 1/2 mounting hole	1	1	1	1	1
76		047 124	CHASSIS, timer	1	1	1	1	1
77		024 366	KNOB, pointer - line indicator	1	1	1	1	1
78			NAMEPLATE (order by model & serial numbers)	1	1	1	1	1



TA-045 216

Figure D - Timer, Delay





Circuit Diagram For Delay Timer

Circuit Diagram No. A-049 250

BE SURE TO PROVIDE MODEL AND SERIAL NUMBERS WHEN ORDERING REPLACEMENT PARTS.

Item No.	Dia. Mkgs.	Factory Part No.	Description	Quantity 020 636	Quantity 020 638
Figure E			**HF Panel (See Fig. C Page 6 Item 54)**		
121	G	020 623	SPARK GAP ASSEMBLY (See Fig. E1 Page 9)	1	1
122		010 886	STRIP, conductor	4	4
123		601 838	NUT, brass - hex jam 3/8-16	8	8
124		016 612	MOUNTING BOARD, component	1	1
125		038 887	STUD, brass No. 10-32 x 1-3/8 w/hex collar	2	2
126	T3	033 601	COIL, coupling - air 500 amp	1	1
127		038 891	STUD, brass 3/8-16 x 2-1/8	2	2
128	T2	036 323	TRANSFORMER, high voltage 115 volts (consisting of)	1	1
	R7	030 724	. RESISTOR, carbon 1 watt 100K ohm	1	1
129	C3	081 291	CAPACITOR, HF (consisting of)	1	1
130		081 282	. STRIP, mounting - capacitor	1	1
131		007 532	. CLAMP, capacitor 1 inch dia	2	2
132		059 887	. CAPACITOR, metal film 10 uf 220 volts	1	1
133	R1	030 603	RESISTOR, WW fixed 10 watt 10K ohm	1	1
134	C2	031 602	CAPACITOR, mica 0.002 uf 5000 volts dc	4	4
135		010 884	STRIP, conductor	2	2
136	C1	031 605	CAPACITOR, mica 0.001 uf 6000 volts dc	1	1
	R6	030 602	RESISTOR, WW fixed 100 watts 10 ohm		1

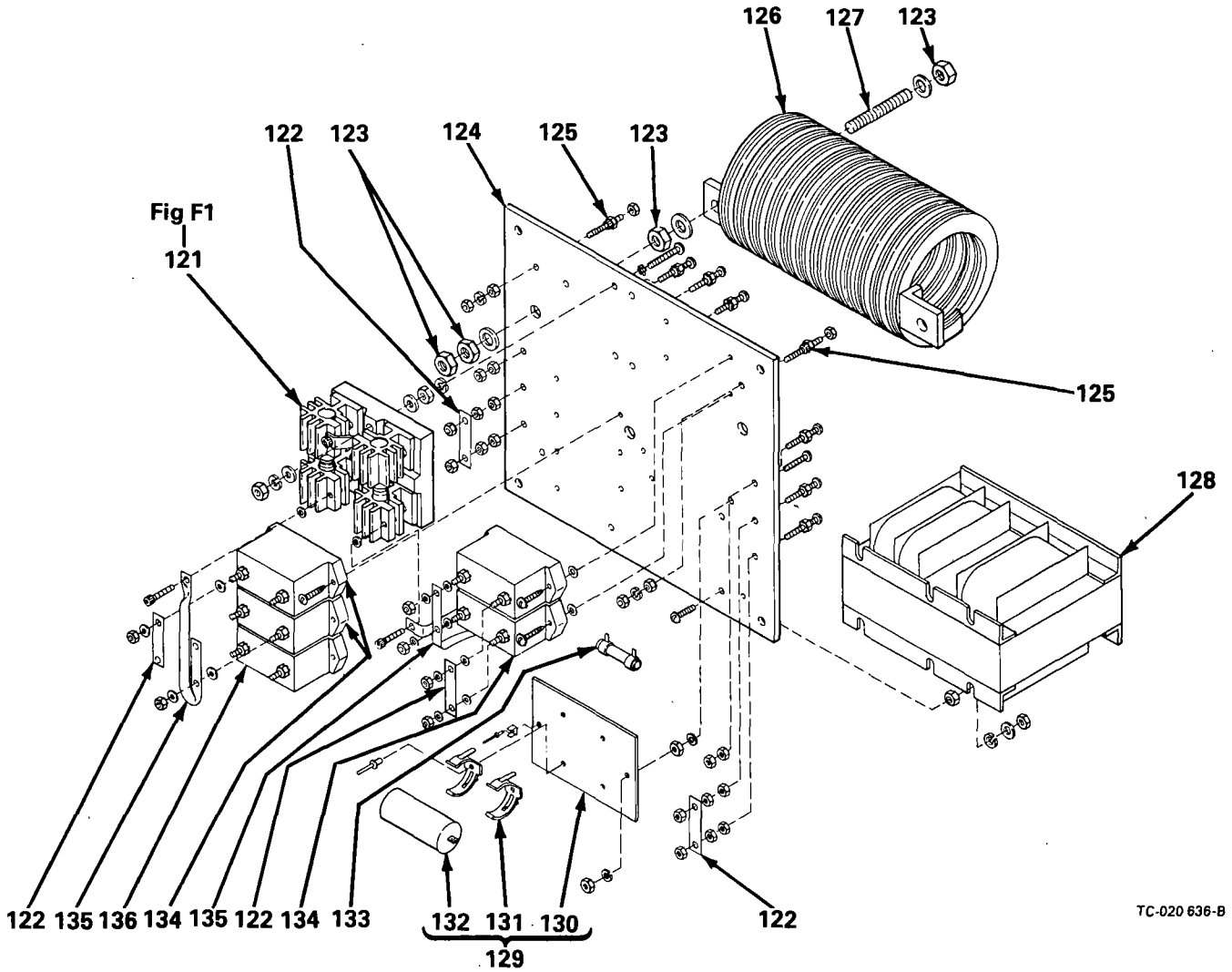


Figure E - HF Panel

BE SURE TO PROVIDE MODEL AND SERIAL NUMBERS WHEN ORDERING REPLACEMENT PARTS.

Item No.	Factory Part No.	Description	Quantity
Figure E1	**020 623**	**Spark Gap Assembly (Fig E Pg 8 Item 121)**	
142	602 023	SCREW, cap - steel socket hd 10-24 x 3/4	4
143	010 888	CONNECTOR, holder - spark gap	1
144	020 622	HOLDER, points	4
145	*020 603	POINT, spark gap	4
146	010 913	WASHER, flat - brass 3/16 ID x 1/2 OD	8
147	020 621	BASE, spark gap	1
148	602 204	WASHER, lock - steel external tooth No. 10	8
149	602 101	SCREW, machine - steel round hd 10-24 x 5/8	8

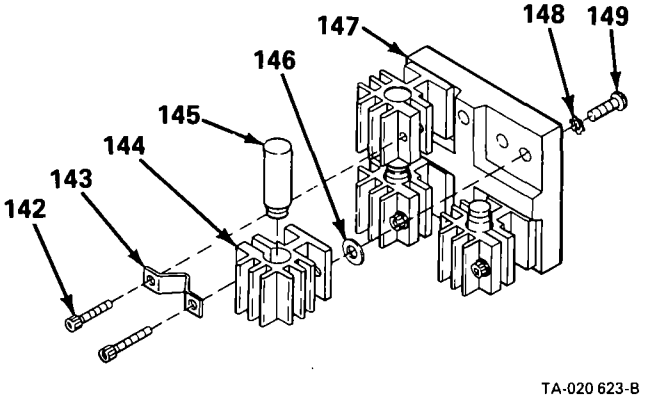


Figure E1 - Spark Gap Assembly

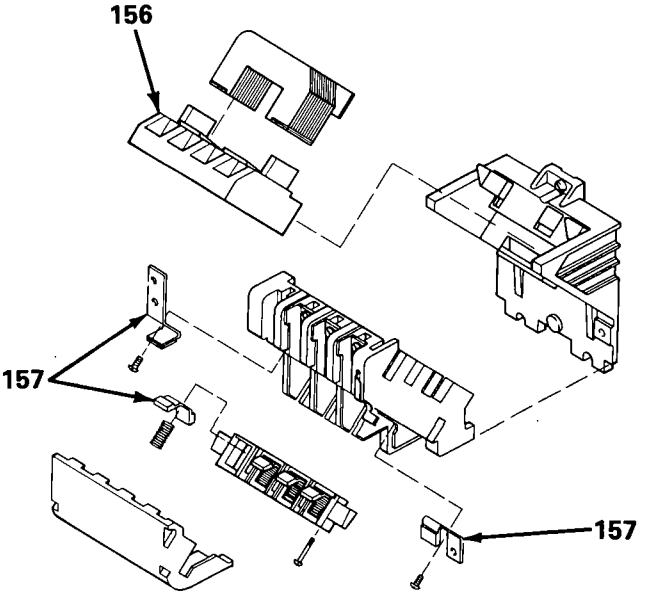


Figure F - Contactor

Item No.	Factory Part No.	Description	Quantity
Figure F	**034 909**	**Contactor (See Fig. C Page 5 Item 43)**	
156	034 910	COIL, contactor 115 volts	1
157	*034 911	KIT, contact - point	4

*Recommended Spare Parts.

BE SURE TO PROVIDE MODEL AND SERIAL NUMBERS WHEN ORDERING REPLACEMENT PARTS.